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IN THIS ISSUE

LAND TENURE IN THE MIDDLE EAST

ISLAND AGRICULTURE IN THE SOUTH PACIFIC

PERUVIAN GUANO

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LAND TENURE IN THE MIDDLE EAST . . . . .

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By Afif I. Tannous*

Since the dawn of human history cultivation of the soil has been carried out along the Mediterranean shores and in the great river valleys of the Middle East. People in that region have depended mainly upon the good earth for a living and for the development of their cultures. Land ownership has been of paramount significance, and consequently a well-defined system of land tenure had already been developed at the time of Roman occupation. When the Arabs took over, during the seventh century A. D., they adopted the then existing system and introduced into it some modifications as demanded by their religious, political, and tribal organizations. Further minor modification was introduced by the Turks. Recently some attempts at reforming the system have been made by the various governments of the region. More effective measures have to be taken, however, if the serious problems resulting from land-tenure practices in the Middle East are to be solved. Some of these arise from feudal tenancy, fragmentation of holdings, and an ineffective form of communal ownership.

THE REGION[1] AND ITS PEOPLE

From a cultural and geographical point of view, the region under consideration may be regarded as the heart of the Arab Middle East. It is a functional socio-economic unit, despite the fact that it consists of five political entities - Palestine, Trans-Jordan, Lebanon, Syria, and Iraq. Its boundaries are geographically determined as follows: On the north by the Taurus Mountains of Turkey; on the east by the Kurdistan Mountain Range; on the south by the sandy Deserts of Sinai and Arabia and by the Persian Gulf; and on the west by the Mediterranean, forming a coast line of about 750 kilometers (466 miles). The total area of the region is about 767,000 square kilometers (296,000 square miles), of which not more than 84,000 square kilometers (32,000 square miles) are under cultivation.

Moving from the seashore inland, one encounters a variety of topographical features. The coastal plain is a narrow strip of land varying in width from a few meters to a few kilometers, most of which is below the altitude of 200 feet. It is composed mainly of fertile alluvial soil. The main mountain range rises abruptly from, and runs parallel with, the coastal plain, reaching its greatest elevation of some 12,000 feet in Lebanon.

Farther east lies the Anti-Lebanon Range, which runs parallel with the coastal range and is separated from it by the high Plateau of Biqa'. The third significant mountain area is that of northeastern Iraq, which is a continuation of the Taurus and Kurdistan Ranges. The remaining greater portion of the region consists of extensive interior plains and high plateaus, partially drained by rivers or streams. In climate also there is marked variation. In general the temperature increases and the rainfall

* Office of Foreign Agricultural Relations.

[1] The discussion includes Syria, Lebanon, Trans-Jordan, Iraq, and Palestine, but not the Jewish settlements in Palestine.

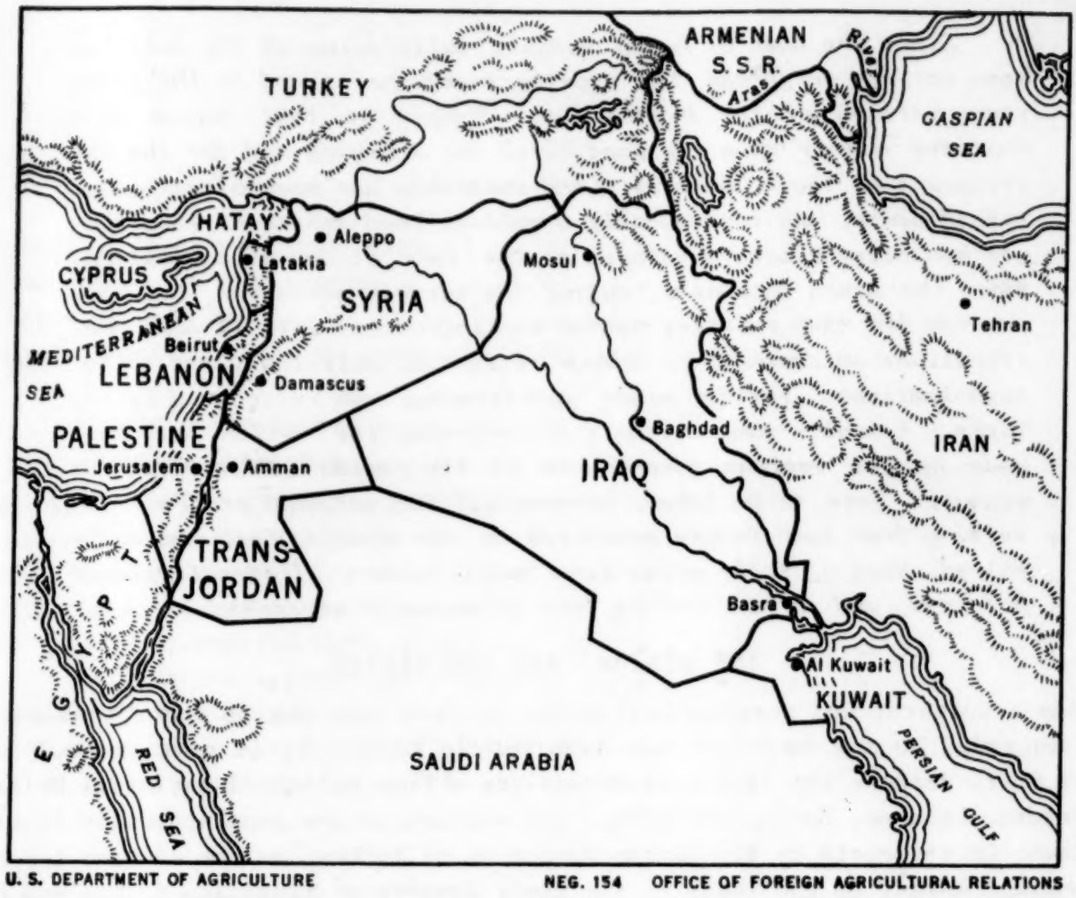

FIGURE 1.—Map of the Middle East.

decreases (from about 35 inches to 6 inches a year) depending upon the distance from north to south and from west to east. In the mountain areas winters are snowy and cold, with high precipitation, whereas summers are cool and dry. At the other extreme is the subtropical climate of the Jordan depression between Palestine and Trans-Jordan.

About 10,000,000 people live within the boundaries of this region. Here also lived their ancestors for a great many centuries - since the dawn of human history. For generation after generation they tilled the soil, adjusted their way of life to the demands of climate and topography, and passed on their experience to their progeny. Nation after nation arose in this most strategic part of the world; conquest followed conquest, yet the tillers of the soil were able to absorb the shocks and go on with their patient work. In a study of the ecological pattern in the area, with attention focussed on its land-tenure system, one must keep in mind that the roots of such a system reach far into the past. It is a heritage toward which many cultures have contributed, with the influence of the Arabs predominating.

The first feature to be discerned in this respect is the pattern of population distribution over the area. The accompanying table gives a clear picture of the situation.

The degree of concentration is fairly high in the fertile Tigris-Euphrates Valley, very high in the less fertile land of Palestine, and extremely high in the rugged mountains of Lebanon. Obviously, the geographical factor alone cannot explain this

TABLE 1.—*Area and population density for certain countries of the Middle East, 1940*

COUNTRY	AREA				POPULATION	POPULATION DENSITY			
	TOTAL		CULTIVATED			TOTAL AREA		CULTIVATED AREA	
	1,000 sq. kilometers	*1,000 square miles*	*1,000 sq. kilometers*	*1,000 square miles*	*Millions*	*Per sq. kilometer*	*Per square mile*	*Per sq. kilometer*	*Per square mile*
Palestine ..	27	10	9	3	1.55	58	150	172	445
Trans-Jordan	90	35	5	2	0.35	4	10	70	181
Lebanon	10	4	2	1	1.00	100	259	500	1,295
Syria	190	73	18	7	2.00	11	28	111	287
Iraq	450	174	50	19	4.00	9	23	80	207
Total	767	296	84	32	8.90	11.6	30	106	275

divergence. Other factors - social, cultural, and political - are involved and must be taken into consideration. A second feature is that the great majority (more than 75 percent) of the inhabitants are directly dependent upon agriculture for a living. A third feature, which has direct bearing on the land-tenure system, is the fact that agricultural settlement in that part of the world has been of the nucleated-village type. All farmers, together with their livestock, live in villages, away from their fields. The significance of this factor will be indicated below. Finally, it must be observed that agriculture among these people is much more than an economic activity; it is a way of life. Consequently, their system of land tenure cannot be analyzed and understood as such in isolation; it has to be approached in the light of its organic relationship with other aspects of the culture, especially religion and the family.

TYPES OF LAND TENURE

In the seventh century A.D. the Arabs conquered the Romans and occupied their territory in the Middle East. The native population, mostly agricultural, remained on the land and were ultimately largely amalgamated with the conquering Arabs. Intermarriage and conversion into Islam were widespread, and the Arabic language was adopted completely. Whatever type of land tenure the Arabs encountered among the natives, they accepted it and modified it according to their religious laws and tribal customs. Several hundred years later, the Turks took over from the Arabs, adopting their religion and a great deal of their culture. They accepted the Arab system of land tenure and introduced into it some modifications. Such is the main background of the system that prevails today in the various countries of the Middle East.

Mulk Land.[2] This is the land that is held in "fee simple," to which the owner has full and free title and can do with it whatever he wishes. If the Arab conquest is taken as a point of departure, two sources of origin for this type of land ownership may be traced. The first is the *Mulk* land that was already in existence when the Arabs took over. In general they left the native owners unmolested. They distinguished, however, between Muslim and non-Muslim owners. The property of the former was designated as *Ushriyah* (paying tenth of the produce) and that of the latter as *Kharajiyah* (paying tribute). The tribute was either in proportion to the produce, but not less than a tenth, or a fixed amount. At present practically no distinction is made between these two categories. The other source of *Mulk* land has been the practice by Arab rulers and the Turkish Sultans of granting land from the state domain to soldiers, tribal chiefs, or local leaders in compensation for military or political

[2] From the Arabic root verb *Malaka*, to own freely and absolutely.

services. This practice gave rise ultimately to the prevalent feudal system of today. Except in Lebanon, *Mulk* tenure is limited to a small portion of the land. For example, in Iraq not more than 2 percent of the land is pure *Mulk*. This is also true of Trans-Jordan, whereas the proportion may be slightly higher in Palestine and Syria.

Miri Land.[3] Two main categories may be distinguished under this type: (1) *Pure Miri*, or that which is completely owned by the state; (2) *Tabu Miri*, or that which is leased out indefinitely to an individual. In other words, this type refers to arable land that is owned by the sovereign or the state. The original source of this type was the land acquired by conquest, which was not claimed by cultivators. Land that was confiscated for any reason, or unclaimed *Mulk* land, provided later sources. The cultivator of *Miri* is virtually its owner, for he can cultivate it as he wishes, bequeath it to his legal heirs, and transfer it. There are, however, certain conditions with which he must conform. One of these is that if the land is left without cultivation for more than 3 consecutive years, it will become *Mahlulah* (free of lease) and will revert to the state as *Pure Miri*. The state is then free to lease it out to the highest bidder, unless the possessor wishes to redeem it by paying a regular fee. Previously another condition provided that no trees could be planted or buildings erected on such land, excepting with the permission of the sovereign. Later this condition was neglected, with the result that any such trees or buildings are owned as *Mulk*, and the land is owned as *Miri*. Thirdly, the owner of *Miri* cannot bequeath it through a will, nor - excepting with the approval of the state - can he change it to *Mulk* or dedicate it for religious or charitable purposes. Payment for the possession and use of *Miri* is made in two forms: (1) By regular fees at the time it is leased or transferred and (2) a yearly tithe or tax. When there are no heirs to claim the land, it reverts to the state. By far the greater portion of land in the countries under consideration is of this category. It amounts in Iraq, for example, to about 95 percent of all arable land.

Waqf Land. The Arabs, since the beginning of their civilization, of which their religious message was the main pillar, developed the practice of dedicating land for religious or charitable purposes. In almost every village one encounters such dedicated land, which is owned by a church, a monastery, or a mosque. One finds, upon investigation, that in each case the dedication was made by the sovereign, a whole community, or an individual who hoped thereby to please the Almighty and invoke his blessings and mercy upon himself and his family. The property offered may be a building, an open field, a whole orchard, or a few trees. The name applied to this form of ownership is *Waqf* (from the Arabic root verb *Waqafa*, meaning to stop or to hold steady and unchanged). Its significance may be indicated by the fact that the old Ottoman government had a special ministry to handle the complicated affairs of the *Waqf* in various parts of the empire. Two forms of *Waqf* have been distinguished, *Sahih* (true) and *Ghair Sahih* (untrue). The first refers to *Mulk* land that has been dedicated in the manner discussed above. It is *true* in the sense that the land offered becomes the absolute property of the religious or charitable organization concerned. No other land but *Mulk* can be changed to *true Waqf*. On the other hand, *Miri* land can be dedicated only as *untrue Waqf*, which means that dedication involves usufruct only and not ownership. Even with such limitation, consent of the state, as the ultimate owner, must be secured first. The dedication of land as *true Waqf* is perpetual. This means that it cannot be exchanged or sold except when replacement is assured.

[3] The land that belongs to the emir or ruler.

Sometimes a *Waqf* is dedicated for the benefit of one's heirs, either perpetually or for a definite period, after which it is turned over to religious or charitable use. Finally, it should be noted that the management of *Waqf* affairs, including court decisions, is mainly in the hands of religious authorities.

Matrukah Land.[4] Every village owns in common some land which is used by the community as a whole for a specific purpose. This may be in the form of grazing ground, local roads and paths, threshing floors, community wood or an open space for village gatherings.

Mawat Land.[5] This is waste or uncultivated land that is not owned or claimed by any individual or community. It is something of a "no man's land," lying outside the traditional boundaries of the village territory. Its location was previously determined by the distance beyond which a voice shouting from the village proper could not be heard. At present this distance is set at 1.5 miles.

Masha' Land.[6] In Lebanon, ownership of land by individual family units is the rule, whereas in Palestine, Syria, and Iraq, a system of community ownership prevails. One can easily see in it a carry-over from the Bedouin tribal organization. In fact, one can still observe this transition in operation on the rim of the desert. Originally the Sheikh, or Headman, of a newly settled village divided its land into so many shares (in Arabic *Asshum*, singular *Sahm*) and assigned an appropriate number of these to each family. Thus what each family owned was a certain share of the common territory and not any specific plot. As generation followed generation, the shares owned by a family were divided and subdivided among its legal heirs. This process continued to such an extent that at present an individual may be the owner of a fraction of several fractions of a share. On the other hand, through marriage, purchase or other means, another individual may come to own several whole shares. In some villages a different method is used; at regular intervals the land is divided into as many shares as there are males, including infants.

As regards the interpretation of share ownership in terms of cultivating the land and reaping its produce, the normal procedure is to divide the village territory into a few sites, according to the quality of the soil, and then assign a portion of each site to each share. Sometimes a whole site is given to each joint family unit or kinship group (in Palestine called Hamulah) which takes care of dividing it among its members. At intervals of from 1 to 5 years the land is repartitioned.

CONDITIONS AND PROBLEMS ASSOCIATED WITH LAND TENURE

Tenancy

Although no accurate figures are available, the belief is that not less than 50 percent of the arable land in the region under consideration is cultivated under the tenancy system. Such a situation is expected in view of the fact discussed above, that by far the greater portion of land is of the *Miri* type. It was the common practice of rulers to offer tracts of this land to local chiefs in compensation for their military or political services. The chiefs in their turn leased the land out to tenants to work it for them. From such beginnings the present system developed.

[4] Meaning literally "left over."

[5] Meaning literally "dead."

[6] From the Arabic root verb *Sha'a*, meaning to be shared in common.

Later, in many cases, whole villages would transfer the land they owned to influential landlords, with a view to securing protection. Gradually such villagers would sink to the level of tenants.

Another equally important factor in the development of tenancy has been the seemingly endless process of transition from nomadism to settled agricultural life by the desert Bedouin. A tribe, in its nomadic state, under the leadership of a Sheikh, owns collectively grazing rights over a certain territory. When settlement is begun, it is natural that the tribal organization, including the leadership of the Sheikh, is maintained. The cultivated land is then owned collectively, with the Sheikh assigning various families shares in it but no permanent plots. Each family gives him a certain portion of the produce. By gradual steps, the Sheikh becomes a landlord, and the members of the tribe assume the status of tenants.

Several problems are associated with this system of land exploitation. One of these is the meager portion of produce received by the tenant. This differs from country to country and from locality to locality within the country, depending upon whether or not the tenant supplies the seed, draft animals, and other equipment. In general it has been estimated that the produce is divided as follows: 10 to 25 percent for the Government, depending upon the category of land; 40 to 60 percent for the landlord; 25 to 50 percent for the tenant. The inadequacy of the tenant's share, which in most cases is his only source of income, is readily apparent from his extremely low standard of living.

Another problem is the lack of effective measures by which a minimum of primary rights can be guaranteed the tenant. Usually, he may be evicted by the landlord without notice. As a rule, no compensation is paid him for improvements he makes or for the losses he incurs when evicted. Also there is no regulation by which the landlord is obliged to supply tenants with a minimum standard of housing. Furthermore, they often need credit to tide them over until the following crop is ready and to meet emergencies. This credit is supplied normally by the landlord, sometimes at exorbitant rates of interest. Consequently, the tenant is almost continuously encumbered by debt, which in many cases he passes on to his children.

Then there is the problem of the exploited land itself. The absentee landlord has no real interest in increasing or even maintaining the productivity of his soil. His main concern is well expressed in an Arabic village saying, "He is after the shallow piaster." He tries to get from his land and his tenants as much as he can, with the least exertion or effort. Consequently, no intensive and diversified cultivation is practiced, and about half the land is left fallow each year in order to maintain a certain degree of fertility. On the other end of the deal is the tenant who is even less interested in keeping the soil in good shape or in improving his agriculture. The land does not belong to him, and he knows that the fruit of any improvement introduced by him will mostly go to the absentee landlord.

During the old Turkish regime there was no law to provide for the protection of the agricultural tenant. In recent years the various governments concerned have become to some extent conscious of the urgency of the problem, and some effort was exerted with a view to finding a solution. The Government of Palestine has taken the lead in this respect. Ordinances providing for the following measures were enacted: (1) Restrictions on the landlord's right to evict tenants. (2) Adequate compensation for losses resulting from eviction. (3) Compensation for improvements made by the tenant on the land. (4) Restriction of the landlord's right to increase the rent. (5) Provision for the security of the evicted tenant in the form of a subsistence

plot. Such measures, however, have been found extremely difficult to put into effect. The letter of the law has been easily evaded. More serious action is necessary.

Scattered Holdings

Family life in the Arab culture, especially among the village folks, has been greatly emphasized. One may observe it in their strong desire for children and in their attachment to a specific locality, which attachment serves to keep members of the family or the kinship group close together. Where a village is newly settled, it may be presumed that there will be enough land to take care of the needs of the few families or kinship group. Each of these is given an appropriate portion in each of the four or five sites into which the village territory is divided. With the appearance of each new generation, however, the family property is divided and subdivided into as many equal parts as there are male children. Each one of these, in his turn, tries to rear a family on the dwindled plots he has inherited. Also, many times purchase and inheritance from the mother's side take place. Consequently, almost every village has come tooffer at present a striking picture of a conglomeration of dwelling places, where farmers and animals live, and a surrounding farming territory that is divided by fences, hedges, ditches, and paths into a great number of small and irregularly shaped plots. Within this territory a farmer, for example, may own about 20 acres, divided into 10 to 15 plots, and scattered in all directions from the village proper. Obviously such a practice is not conducive to high agricultural efficiency.

Communal Ownership

This form of land tenure was described above in detail. The main problem it involves is that it tends to deprive the farmer of the initiative for agricultural improvement. This is the result of its inherent character, which is neither individualistic nor genuinely collective. Possibly at first, when the Bedouins began settling down on the land, Masha' was an effective method of agricultural exploitation that fitted into the tribal organization. Today, however, it is altogether antiquated. The Masha' farmer, who knows that in a year or two he will not be cultivating the same piece of land, does not feel inclined to fertilize it, to plant it with fruit trees, or to make permanent improvements. "Why should someone else reap the benefit of my work?" he reasons. For this reason, native and foreign experts have agreed upon condemning Masha' as the greatest obstacle to agricultural rehabilitation in the Middle East. A serious attempt at surveying and partitioning such land has been in progress for the last 10 years.

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ISLAND AGRICULTURE IN THE SOUTH PACIFIC . . . . .

By Wolf I. Ladejinsky*

The islands that comprise the Australian and Japanese mandates are too numerous and information is too fragmentary to warrant any comprehensive account of them. Some of the main economic features of certain island groups can, however, be outlined. The agricultural economy of these may be divided into plantation and native, the latter of which means gardening and collecting fruit from wild trees. The ultimate end of all agricultural efforts on the part of the natives is to satisfy requirements for food, and in this respect the coconut plays the main role. Copra exports come from the European-owned plantations, which devote 95 percent of their total acreage to the growing of coconuts. The only other agricultural export is sugar, processed from sugarcane raised by the Japanese. On the whole, the islands are not surplus food producers. Most of the food consumed by resident nonnatives, be they European or Asiatic, must be imported. The possibility of expanding acreage, improving farm practices, and introducing new crops is not excluded, but to date efforts in that direction on the part of nonnatives have met with little success.

AUSTRALIAN MANDATED ISLANDS

This mandate, otherwise known as the Territory of New Guinea, is made up of Northeast New Guinea, Solomon Islands, New Britain, New Ireland, and Admiralty Islands. The Territory covers an area of some 60 million acres and has a native population estimated in 1941 at 900,000, in addition to nearly 5,000 Europeans and 1,500 Chinese.

The climate and precipitation of the islands favor the cultivation of a great variety of tropical products. The soil, too, lends itself to farming. In a number of the islands and in Northeast New Guinea, all kinds of land are found, from coral atolls to granite peaks. Part of the land is flat and comparatively low lying. The soils range from sandy to light sandy loam, usually overlying a subsoil of broken coral, especially suitable for coconuts. The soil of some of the larger islands is of a heavier nature, grading from sedimentary deposits to rich and, in a few cases, to fertile volcanic soils. Not only has the Territory relatively good soils and sufficient precipitation, but it is also outside the cyclone and hurricane belts, another factor that favors agricultural development there.

Acreage

Data regarding the total acreage suitable for cropping or acreage actually under crops are not available. Statements have been made that the area already set aside for cultivation, if planted to its full capacity, would be far greater than the present native population could handle. Since the statement is not backed up by any estimate, and the acreage cropped by the natives, as distinguished from that of European plantations, is not indicated, the question of the total cropped area of the islands under

* Office of Foreign Agricultural Relations.

the Australian mandate remains open. Only the acreage of the existing 517 plantations is known; in 1940 they had a combined area of 525,000 acres, or not quite 0.5 percent of the total area. About half the plantation acreage is under cultivation.

Agricultural Production

Plantation agriculture

The agricultural economy of the islands falls into two categories, plantation and native. A fair amount of data relating to the former is available, but little about the latter. The agricultural mainstay of the plantations and, in fact, of all the islands is the coconut. The coconut palm, which is indigenous to most of the islands, has yielded food for the natives and copra for export since the beginning of European trade, particularly since plantation development. The extent to which the coconut dominates plantation agriculture, and for that matter all agriculture, may be gleaned from the fact that 95 percent of the cultivated plantation area is devoted to its production. In 1940 the total coconut-bearing area amounted to 211,000 acres, yielding 72,000 tons of copra and 696 tons of desiccated coconut.

Most of the copra output is exported to the United Kingdom, Australia, and the United States, but small amounts go to various European countries. Before the discovery of gold in 1926, copra comprised over 90 percent of the islands' total exports. With the expansion of gold production and the decline in the price of copra in the 1930's, the share of copra in the export trade declined sharply to 16 and 15 percent in 1934 and 1935, respectively. On the other hand, the volume of total shipments, ranging from 60,000 to 70,000 tons, has been maintained except in 1941, when exports declined to 50,000 tons.

In addition to copra, the plantations have small areas under cacao, coffee, kapok, hemp, rubber, and rice. Some tobacco is being produced, but not in sufficient quantities to satisfy domestic needs. A little rice is grown on plantations and in native villages to augment local food supplies, but most of the rice consumed has to be imported. The climate and soil of the Territory are also suitable for the cultivation of Manila hemp, nutmeg, vanilla beans, and corn; but the cultivation of these products either has not advanced beyond the experimental stage, or has been attempted on a small scale only.

Native agriculture

As already pointed out, quantitative information concerning native agriculture is rather meager. If one allows for local variations, however, the general character of native agriculture can be described. The holdings of the 900,000 natives are small; they produce food crops in their gardens or merely collect food from wild trees in quantities sufficient to satisfy their not-too-great needs; they furnish only a small volume of the agricultural products shipped abroad; and, from an American point of view, their methods of farming are primitive.

A study of the economy of New Guinea,[1] based on field observations in a few villages, sheds considerable light on the nature of the native farming. Much of it is carried on in gardens which vary in size from 0.5 acre to 3 acres. Every adult male has a right to cultivate one or more gardens, depending upon his rank or position in

[1] HOGBIN, H. YAN. TILLAGE AND COLLECTION A NEW GUINEA ECONOMY. Oceania [Australia.], 9: 127-151, illus.

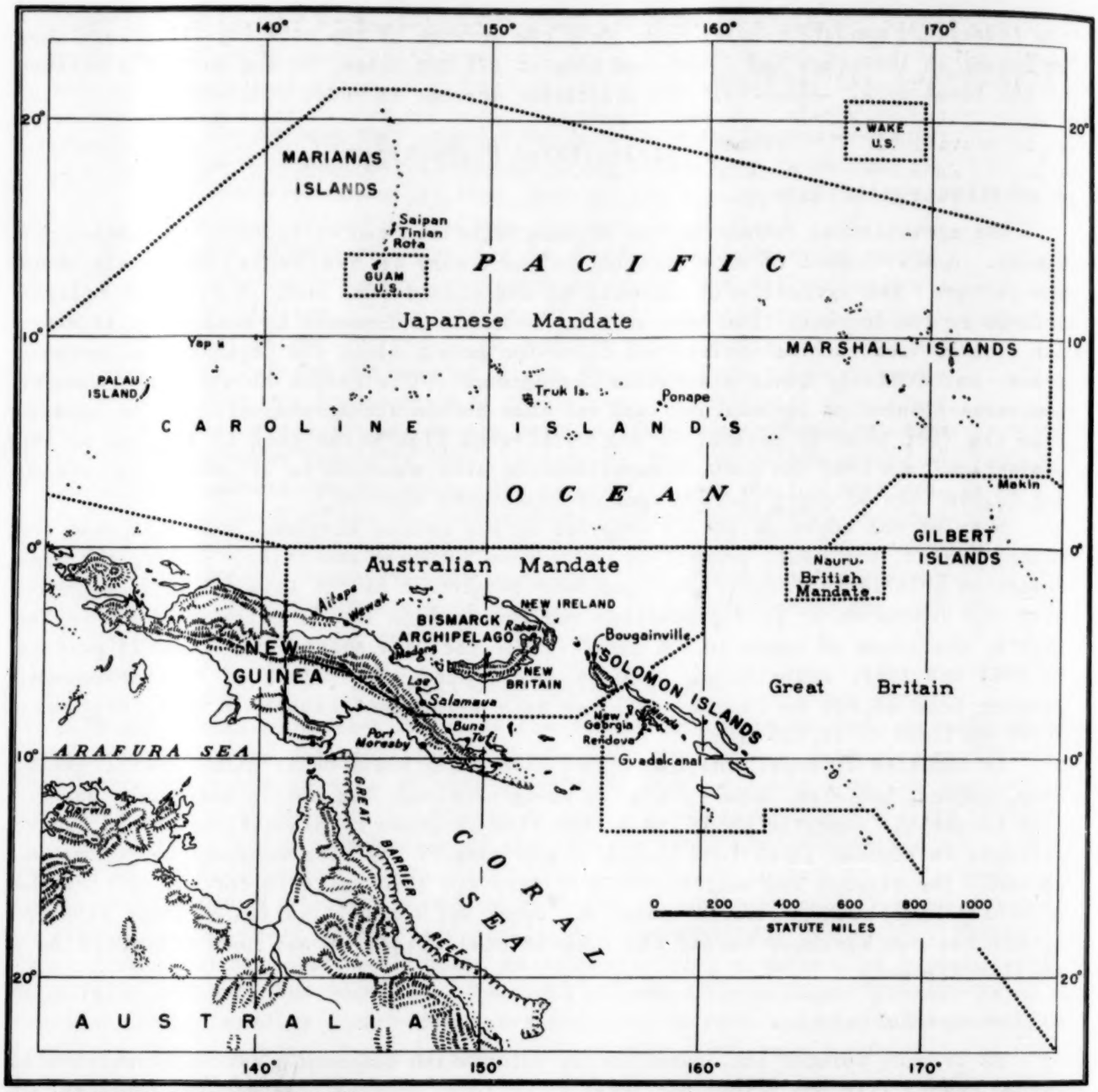

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FIGURE 1.—Principal islands of the Australian and Japanese Mandates.

the community. Since the soil is poor and crop rotation or manures are totally unknown in New Guinea, the natives are compelled to make new gardens after one or two plantings. Eventually the old plots are used again, but not for 10 or 12 years.

As regards the nature of the food consumed, the author noted that: "Pigs are kept to provide meat for feasts and, in addition, fish are available on the coast, as well as a number of wild animals in the interior; but vegetables, fruit and nuts are everywhere regarded as the most important foods."[2] Among the vegetables, taro and bananas constitute the staple foods. These two items, in addition to some herbs,

[2] *Ibid.*, p. 127.

sugarcane, tobacco, yams, and sweetpotatoes are cultivated by the natives in their gardens. But they also depend on many palms and forest trees, some of which they plant themselves. The chief of these, as already pointed out, is the ever present coconut followed by the sago palm. Another important forest product is the breadfruit; when taro is unavailable, it becomes the most important item of most meals. Considerable fishing is done, but fish is a supplementary rather than a substitute food and does not take the place of the above-mentioned items.

Despite the seeming primitiveness of the native agricultural economy, it has not escaped altogether the effects of the agricultural work carried on by the nonnatives. Some new crops, metal tools, and cattle have been introduced, albeit on a small scale only. They provide the natives with a greater measure of economic stability, but one must emphasize that the new takes root only when it fits in easily with the accepted ways of the natives. A writer has recently pointed out, in this connection, that

"the drying of copra, for example, has kept the native on familiar ground. By contrast, a product that demanded the learning of unfamiliar technical processes, involved serious shifts in the division of labor in order to attend to it, needed elaborate financing to launch it, or gave results only after a long period would rarely be of interest. Thus rice culture has not been adopted extensively by the Oceanic folk even when Asiatic immigrants have demonstrated how to grow it; the crop exacts, among other things, great labor and care."[3]

This may explain why attempts on the part of the Western or Asiatic powers to stimulate the natives into a more profitable economic pattern of activities have shown only limited results.

One may say, in summing up, that, with the exception of coconuts, the islands of the Australian Mandate are not surplus food producers. The food requirements of the natives are meager enough, but judging by import data their production falls somewhat short of their needs. Furthermore, practically all the food consumed by the 4,000 resident Europeans must be imported. Official accounts indicate that food production

TABLE 1.—*Number of plantations, cultivated area and production of principal crops, and livestock numbers of the Australian Mandate, July-June 1939-40*

ITEM	UNIT	NEW BRITAIN	NEW IRELAND	MADANG	MANUS	KIETA	SEPIK	MOROBE	TOTAL
Plantations	No.	147	164	63	61	19	41	22	517
Area	Acres	200,877	121,865	62,810	69,880	11,179	34,631	24,722	525,964
Cultivation	Acres	88,813	79,569	37,441	31,098	4,169	25,839	6,232	273,161
Coconuts:									
Acreage planted	Acres	82,366	78,961	35,780	29,464	3,538	25,839	5,728	261,676
Acreage bearing	Acres	59,297	65,472	28,268	25,053	3,178	24,418	5,268	210,954
Production copra	Tons	20,812	20,625	11,832	10,508	855	5,662	1,289	71,583
Production desiccated	Tons	446	-	250	-	-	-	-	696
Cacao:									
Acreage planted	Acres	2,053	15	96	388	-	-	-	2,552
Acreage bearing	Acres	996	-	96	84	-	-	-	1,176
Production	Tons	144	-	45	21	-	-	-	210
Coffee:									
Acreage planted	Acres	1,764	82	52	729	124	-	-	2,751
Acreage bearing	Acres	1,255	82	27	554	7	-	-	1,925
Production	Tons	11	2	1	29	5	-	-	48
Livestock:									
Horses	No.	476	256	379	27	29	9	147	1,323
Mules	No.	-	-	1	3	3	-	-	7
Cattle	No.	4,144	4,180	6,930	2,458	400	483	1,899	20,494
Sheep	No.	266	403	129	177	-	77	132	1,184
Goats	No.	928	4,602	536	1,149	1,171	700	241	9,327
Pigs	No.	1,831	1,056	1,142	735	181	691	524	6,160

Pacific Islands Yearbook, Sydney, Australia, 1942. p. 282.

[3] KEESING, FELIX M. THE SOUTH SEAS IN THE MODERN WORLD, 383 pp., illus. John Day Co., New York, 1941. (See p. 132.)

in the Territory can be expanded. Past experience, on the other hand, suggests that such a development could not be carried out rapidly and that the types of food which could be produced would not answer the needs of a materially increased number of Europeans, be they civilian or military. As in the past Australia and New Zealand would have to provide them with the bulk of their food requirements.

JAPANESE MANDATED ISLANDS

This Territory consists of a number of island groups, of which the Marianas, the Carolines, the Marshalls, and Palau are the most important. They are scattered over a vast expanse of water in the western Pacific north of the Equator, about 1,300 miles from north to south and about 2,700 miles from east to west. The entire Territory comprises 623 islands and 867 reefs, with a total land surface of only 532,000 acres. The largest single island, Ponape in the Carolines, has an area of 193,000 acres, and the island of highest economic development, Saipan, in the Marianas, has an area of 45,000 acres. From an agricultural point of view, the predominantly small size of the islands and the scarcity of good soil considerably reduce their value. The total population of the islands as of June 30, 1939, was estimated at 113,553, comprising 40,406 natives, 73,028 Japanese, and 119 foreigners.

All the islands have a tropical climate, the average daily temperature being 86°. Their small size, the winds that blow from the sea throughout the year, and frequent squalls temper the heat considerably. The average annual rainfall is more than 120 inches, and at Ponape it reaches 160 inches. The precipitation is greatest during July, August, and September and least in January, February, and March. The torrential nature of the rains and the rapid run-off limit the benefit agriculture derives from the heavy rainfall.

Practically all the islands are composed of volcanic rocks and coral reefs. With the exception of the island of Saipan, which is fertile and well adapted to the cultivation of sugarcane, the soil of most of the others is little suited for general agricultural activities. At best, as in the Marshalls, it permits the growth of coconut palms, a limited variety of other tree crops, and in some cases a little corn and sweetpotatoes.

Plantation Agriculture

Information regarding the total crop area is fragmentary and conflicting; but, since the total land surface of the islands is 532,000 acres, it cannot be large. According to a Japanese source, the total area of arable land of all the islands was placed in 1938 at 57,000 acres; but an area, estimated at about 62,000 acres, could be reclaimed for the cultivation of agricultural crops. In addition, palm groves occupied about 79,000 acres of reclaimed land. All this indicates a region of limited agricultural output.

The principal commercial crops produced in the Japanese mandated islands are sugarcane and copra. The center of sugar production is in Saipan, in the Marianas. By 1930 most of the available land suitable for sugar cultivation was already in use, and the sugar plantations were expanded to the nearby islands of Tinian and Rota, near the American possession of Guam. The entire industry - from the growing of cane to the processing of refined sugar - is in the hands of the Japanese South Seas Development Company. Various reports state that the company operates from three to four sugar refineries, with a total capacity of from 4,100 to 5,300 tons of crushed cane per day.

Sugarcane cultivation in the South Sea Islands dates as far back as the sixteenth century, and in pre-Japanese days the little sugarcane raised by the natives was consumed by them unprocessed. In 1916 only 45 acres were under cane, but during the season of 1937-38 the area increased to an estimated 47,000 acres. The volume of sugar output in 1937 amounted to 60,000 tons, and exports in 1938 totaled 46,000 tons, valued at 21 million yen.[4]

The rapid development of the sugar industry was due, to a large extent, to the privileged position accorded the South Seas Development Company by the Japanese Government. The land under cultivation on the company's plantation was obtained from the Mandate Administration, free of charge. No enterprise, other than the South Seas Development Company, was permitted to enter the field. Even the cane grown by private cultivators had to be sold to the company. Thus, the latter had a complete monopoly of the sugar resources of the islands. In addition, the Government aided the company by subsidies, which during 1929-31 averaged 500,000 yen per year, and by tax exemptions that actually augmented the generous subsidies.

The industry is served entirely by imported Japanese laborers. They work in the refineries, on the land directly managed by the company, or as sugarcane growers on company land under tenancy contracts. In 1938 approximately 21,000 Japanese were thus employed. Altogether in 1937, 42,547 Japanese, or 68 percent of the total number in the mandated islands, were residing in Saipan, the center of the sugar industry. The natives, on the other hand, were not employed by the company in the refineries or as laborers or tenants on the company's sugar plantations.

In the season of 1937-38 the sugar plantations of the company covered an area of 29,000 acres. In addition, 2,448 tenant households cultivated 18,000 acres under cane. The tenants lease the land from the company, the rental depending upon the productivity of the land. In general, the rental amounts to 15 percent of the crop. The independent cultivators play a negligible role in the sugar economy of the islands. These cultivators differ from the tenants in their relationship to the company. They have a right to raise any crop, but if they grow cane, it must be sold to the company. In 1938 there were only 101 independent cultivators, with a total area of 800 acres. Only 41 were native cultivators, who operated on 230 acres.

The Japanese Administration was bent on developing all other resources of the islands. In the main, this meant only agricultural resources. With that view in mind, subsidies were also paid for the purpose of stimulating the production of vegetables, the planting of coconut trees, the raising of livestock, and the development of the fishing industry. With the possible exception of the fishing industry, however, the attempted expansion of the undertakings mentioned above appears not to have met with much success. Information concerning the area under food crops is not available, but data on the import and export of foodstuffs indicate that the nonnative population must import not only rice but fruit and vegetables as well.

The one other commercial agricultural product is copra. The ubiquitous coconut palm flourishes in the coral islands and along the coast of the mountainous groups. The area of the palm forests in the Japanese mandated islands has been estimated at about 72,000 acres of which 28,000 acres are on the coral reefs of the Marshall Islands; Ponape has 16,000; Truk, 10,000; and Yap, 8,000 acres. The copra obtained from these forests is not only one of the most valuable articles of export, but, more important, it constitutes an indispensable item in the diet of the natives. The profits obtained

[4] The average value of the yen during 1938 in U. S. currency was about 28.5 cents.

by the natives from copra sales play an increasingly significant role in their livelihood. Information concerning the acreage in bearing and the coconut output is lacking. The Government owns 9,000 acres of coconut groves, but little is known of the coconut acreage actually in the hands of the natives. The annual export of copra is between 13,000 and 14,000 tons, with an estimated value of over 2 million yen.

Native Agriculture

With the exception of part of the coconut crop, which is sold as copra, all the agricultural activities of the natives are devoted to the acquisition of food. The islands are so favored by nature, and the needs of the natives are so limited, that they have always been able to secure the necessities of life without expending much effort. As a result, the equipment and agricultural methods of even the most advanced of them are still primitive. Scarcely any farming is practiced in the accepted sense of the word, since a few seeds scattered broadcast generally produce a crop with relatively little cultivation or attention. Essentially, the principal food is obtained from wild plants and wild vegetables merely by collecting it.

In addition to the food the natives raise or collect in the forests, they also buy such foodstuffs as rice, other imported grains, or tinned goods, but usually only when they run short of their own provisions, which consist of coconuts, breadfruit, taro, yams, sweetpotatoes, and tapioca. The most highly prized delicacies are beef, pork, goat meat, poultry, pigeons, dog meat, crab, and such fruits as oranges, pineapples, mangoes, bananas, and papayas. Despite the love for meat, stock raising is on a small scale and in a crude stage.

Fishing

Relatively little fishing is done by the natives, although bonito, tunny, mackerel, sardine, and shark are in abundance in the neighboring waters. Formerly, any fish they caught were intended for their own consumption. With the coming of the Japanese, however, and with the financial backing of the Japanese Government, an important commercial fishing industry came into being. The mainstay of the industry is bonito fishing carried on in the waters of the Territory. The total value of all the catches in 1937 amounted to 6,862,000 yen.

Altogether, with the exception of sugarcane, the agricultural resources of the Japanese mandated islands are rather scanty. The fact that the total land surface of 623 islands and 867 reefs is only slightly more than 500,000 acres is in itself an unsurmountable, limiting factor. Furthermore, in the course of some two decades the Japanese succeeded in putting to use most of the cultivable land of the islands. At best, not more than 50,000 acres are still available for future development. Even if the total area of the islands and that of the cultivated land were larger, however, the islands would not be counted among surplus food producers. This is due to the pattern of the agricultural economy introduced by the Japanese; namely, the concentration on one export crop, sugarcane, to the exclusion of more important subsistence crops. For this reason the Japanese population on the islands largely depends upon imported food. Consequently, although the Japanese mandated islands are in a position to provide the natives with their rather moderate food requirements, they cannot, and surely not on short notice, feed nonnatives.

§

PERUVIAN GUANO . . . . .

By Elizabeth P. Tappy*

Far beneath the surface of the South Pacific, certain changes, apparently due to cyclic fluctuations of the climate, have taken place, which have injured one of Peru's vital industries - the extraction of guano. Unfavorable oceanic conditions prevailing since 1939, which have not yet been normalized, have had harmful effects upon the anchovies (anchobetas) *and other marine life that abound in the coastal waters of Peru. These fish are the principal food of certain birds inhabiting the islands off the coast of Peru, whose vital excrement forms a rich nitrogenous fertilizer called Peruvian guano. The diminishing supply of anchovies has caused heavy mortality among the birds and their virtual disappearance from some of the islands. The economic well-being of Peru is largely dependent upon the return of these conditions to normal.*

From time immemorial Peru has been dependent upon fertilizer in cultivating its land. It was partly through the wise administration and use of guano that a high stage of agricultural development was attained by the Inca Indians. After the Spanish conquest agricultural and industrial life fell into a decline, and the guano industry was not resumed on a large scale until about 1843. Then began an era of such wholesale extraction under the wasteful contract system, with its cut-throat competition, that the country's agriculture was threatened by possible exhaustion of deposits, and the national credit became insecure. Finally, in recent years, under the regime of a government monopoly, the Compañía Administradora del Guano, *an exploitation was converted into a well-managed and profitable industry. At a time when there is a crying need for food and more food to feed a post-war world, it is particularly unfortunate that a crisis impossible to control should overtake the Peruvian farmers, who need abundant supplies of this rich fertilizer to increase their food supply.*

THE GUANO ISLANDS

Along the coast of Peru and in the path of the Humboldt current are 43 small islands or groups of islands on which certain marine birds deposit their valuable excrement, a guano containing from 12 to 16 percent nitrogen. Of greatest importance are the Chincha and Ballestas Islands, Guañape, Macabi, and the Lobos Islands (see figure 1). Of secondary importance are the Santa, Palominos, Asia, Santa Rosa, and Cerro Azul Islands.

All these islands are small and close to the coast. The Island Loberia near Cerro Azul can be reached by aerial trolley from the mainland. Most of the islands are not more than 10 or 12 miles away, although Lobos de Afuera is 33 nautical miles from the nearest point of the coast. The largest of the islands, Lobos de Tierra, is

* Office of Foreign Agricultural Relations.

Courtesy of *The National Geographic Magazine*

FIGURE 1.—Sketch map of the Peruvian coast, showing the prevailing oceanic circulation and the position of the principal islands.

about 6 miles long and varies from 0.5 to less than 2 miles in width. The smallest and southernmost island of the Chincha group near Pisco has an area of about 40 acres, the greater part of which is the nesting ground of birds. Edaphic and atmospheric conditions prevent the growth of vegetation on the islands except on the highest peaks that receive moisture from the clouds. The northern current, "El Niño," frequently extends as far south as the Lobos Islands at latitude 6.5° south but even here vegetation is sparse, and rain is rare.

The presence of these deposits on the islands results from a chain of circumstances, seemingly unrelated, and to an array of phenomena unequaled in any other part of the world. The cold Humboldt current propelled northward by southerly and southeasterly winds flows along the South Pacific Coast toward the Equator and bathes the tropical shore of Peru. The upturning of cold bottom waters has produced conditions favorable to the propagation of an abundance of small fish, called anchobetas, which swarm in schools in the Peruvian current pursued by bonitos and other large fish, and which are prey to the thousands of marine birds attracted to the coast and islands by this abundant supply of food. Breezes from the ocean pass over the cold waters of the Humboldt current precipitating moisture in the form of dense fogs but leaving no opportunity for rainfall on the islands and coast. The rainless climate preserves the nitrogen content of guano deposits for long periods and also affects the propagation of the birds.

GUANO-PRODUCING BIRDS

Three species of guano-producing birds are of outstanding economic importance: One cormorant, the *guanay*; one pelican, the *alcatraz*; and a gannet, the *piquero*. Although many other birds frequent these islands, and even nest there, most guano is derived from these three.

The guanay, so named, as some believe, for its productivity, is first in importance as a guano producer. This species is found along the entire coast of Peru but occurs

most frequently on the Lobos de Tierra and in the south on the Ballestas and Chincha islands. The guanay, being of a gregarious nature, nests in large droves on the level places and gentle slopes of the islands. Its habit of remaining on the islands, except when in search of food, and the almost continuous nesting season make it the chief source of guano deposits, of which there is little waste.

The piquero, second in commercial importance, is also the second most abundant of the sea fowl. The islands most frequently inhabited by the piquero are the Chincha, Lobos de Tierra, and the North and South Guañapes.

The pelican, or alcatraz, at one time ranked next to the guanay as a producer of fertilizer, but that position has now been usurped by the piquero, leaving the pelican in third place. The pelican is not only found in smaller numbers than the guanay and the piquero, but its guano is less abundant and of an inferior quality.

Ranking least in importance is the camanay, or the "blue-footed booby," a larger variety of the gannet. This bird inhabits the northernmost islands and seldom breeds south of the Lobos de Afuera.

NATURE OF GUANO

"Peruvian Guano" is a rich nitrogenous fertilizer in a form easily assimilable by growing plants. Although other minerals are essential to a fertile soil, nitrogen is a prime necessity. Peruvian guano is primarily the deposit of fish-eating birds; but mixed in with this deposit in varying proportions may be other substances, such as eggs, bodies of birds, deposits of sea lions, as well as some sand and gravel. Factories have devised means of making a nitrogenous fertilizer from fish; but these methods are expensive, and Peruvian as well as other farmers are dependent on a cheap fertilizer.

Billions of fish are consumed each year by the birds. Of these, the anchobetas, which multiply so rapidly that the supply is usually abundant, and the brightly colored, shrimplike crustacea are the most important.

DEVELOPMENT OF THE GUANO INDUSTRY

Guano was deposited for centuries and left undisturbed by the outside world. Relics of pottery and metalware found on the guano islands, however, suggest that the ancient Inca Indians, who inhabited Peru until the Spanish Conquest, found in nature a compensation for the arid lands of the coast. The conditions that made the land arid have preserved for them this invaluable fertilizer. The Incas reached a high stage of agricultural development. They carried guano from the islands to cultivate their fields far over the naturally arid coastal regions of the mainland and even into the high Sierra. The value of nature's gift was fully appreciated by the Incas, and they protected its source by enacting laws for the preservation of the birds and administered the extraction of the guano so as to conserve the supply.

When the Spanish *conquistadores* arrived, they followed the opposite course and exploited the resources of Peru; but their interest was in precious minerals. The subjugated Incas were forced to leave the cultivation of their fields and spend their lives mining gold for the avaricious Spaniards. Consequently, a decline in agricultural development resulted. The tremendous deposits of guano, lying in thick beds and representing the accumulation of hundreds of years, were meanwhile left intact.

Guano was rediscovered about the second quarter of the nineteenth century. At this time nearly all the islands along the Peruvian coast from 6° to 21° 2' south latitude were rich in deposits. The richest of these were on the Chincha and the

Lobos Islands. Between 1850 and 1872 nearly 11,000,000 tons of high-quality guano, containing between 13 and 14 percent nitrogen and about the same percentage of phosphoric anhydride, are said to have been exported from the Chincha Islands alone. A Peruvian survey showed 13,376,100 tons to be available in 1853. Reports state that as late as 1861 these islands were covered with a solid layer of guano over 100 feet thick. By 1873 deposits on the Chincha Islands were becoming exhausted, and the guano output dropped to 11,634 tons.[1]

Guano was sent experimentally to England as early as 1826 but did not become a regular commercial commodity until 1839, when a Lima firm claimed to have purchased from the Peruvian Government title to the guano for the sum of $60,000. When this contract was cancelled by the Peruvian supreme court, the same Lima firm made a loan of $280,000 to the Government for exclusive export privileges. This contract was merged into another in February 1842, involving an additional loan of $245,000, and the firm was given the exclusive privilege of exporting 126,000 tons of guano within 5 years. Gibbs and Company, a London firm, had by this time become the principal participant, and a later contract of December 22, 1847, temporarily gave exclusive export privileges to this firm.[2]

In 1843 extraction began on such a tremendous scale as to amount to a "boom industry." The islands were surrounded by ships, 50 or more at a time, and hundreds of thousands of tons of guano a year were transported to Europe. One island alone is said to have been leveled by the removal of nearly 200 feet of guano.

From the beginning of the guano trade until January 1, 1858, Peru exported about 3,277,302 tons to foreign markets. Of this amount about two-fifths was shipped to Great Britain, one-fifth to the United States, and the remainder to France, Spain, and other countries. In 1857 Peruvian guano exports reached a peak of 490,654 tons.[2] The consignment system, the basis for all exportation during this period, was favorable to the Peruvian Government. Revenues paid the Government were so great that it was unnecessary to tax the people. Government contracts were let for extensive irrigation systems, railways, harbor improvements, and other public works, with the result that the future of the guano industry was mortgaged to pay the cost of these undertakings. After a time, rumors of the possible exhaustion of guano deposits became widespread and threatened the national economic security. As the guano deposits were being depleted, other varieties of fertilizer appeared on the market. Nitrate of soda, deposits of which were located in the Province of Tarapacá (now incorporated in Chile), offered direct competition to the government-owned guano deposits.

At the end of the nineteenth century a readjustment was finally made, and the industry continued largely for domestic use and to a much lesser degree for foreign trade. Not only was Peru's national credit somewhat insecure, but its agriculture was threatened. The guano deposits had been so mortgaged for payment of the bonded debt that the greater part of the guano extracted had to be exported. The sugar and cotton planters were dependent on the availability of a cheap fertilizer, but requirements of agriculture could not be filled. Only about two-thirds of total requirements, estimated in 1907 to be 40,000 tons annually, could be met. In that year, of about 124,000 tons of guano extracted, only 26,000 tons were available for agriculture in Peru. Because the demands of agriculture were not being met, exports fell off from

[1] MURPHY, ROBERT CUSHMAN. BIRD ISLANDS OF PERU. 362 pp., illus. G. P. Putnam's Sons, New York and London. 1925.

[2] NOLAN, LOUIS CLINTON. THE DIPLOMATIC AND COMMERCIAL RELATIONS OF THE UNITED STATES AND PERU, 1826-1875. 360 pp. [Thesis, Ph. D., Duke Univ. Typewritten.]

65,266 metric tons[3] in 1911-12, to 18,706 in 1915-16, and during the 4 years that followed there were no exports. Exports were resumed in 1920 and during the next 15 years averaged about 21,998 metric tons; then they again declined. In 1940 and 1942 no guano was exported and in 1941 only 8,747 metric tons.

GUANO TRADE WITH THE UNITED STATES

Guano was first introduced into the United States in 1841, when James C. Pickett of Kentucky, United States diplomat in Peru, wrote to Secretary of State Daniel Webster calling the attention of his Government to the vast guano deposits lying unused on the islands. From 1844 until 1861 an extensive guano trade developed between the United States and Peru, with Baltimore as the chief center of distribution. The depleted tobacco lands in the upper Southern States and the cotton lands in the deep South were in need of a rejuvenating fertilizer; consequently, it was the South that became the central theater of demand. Farmers were overoptimistic. An article in a leading periodical of that time reflected this optimism as follows:

"And here begins another revolution - all the old worn-out tobacco lands in Maryland and Virginia, the sand hills along the sea coast of Virginia and North Carolina ... - all these will ... become converted to the most arable and productive soils of the country .... In effect, this article, *Guano*, will transfer the Western lands to the Atlantic!"[4]

No revolution took place, however, and although guano proved useful it soon became evident that the price was too high and the supply irregular and undependable. The price to United States east-coast farmers rose from $46.20 per ton in 1852 to $65 per ton in 1857. The supply was ample only in 1854 and 1855. Although 66,000 tons entered the United States before 1852, Baltimore agents were practically without stocks from 1848 until 1852.

Until the Civil War, guano amounting to a total value of $16,000,000 was imported into Baltimore alone, and of this amount all but approximately $2,000,000 worth was imported between 1852 and 1861. The greatest quantity shipped to the United States was in 1854, when 159,654 tons were reported.[5] Figures covering imports into Baltimore during the period 1844-70 are revealing:

TABLE 1.—*Guano imports into Baltimore, specified years*

YEAR	QUANTITY IN TONS	YEAR	QUANTITY IN TONS	YEAR	QUANTITY IN TONS
1844	445	1852	25,000	1860	54,134
1845	0	1853	32,152	1861	27,424
1846	1,170	1854	-	1862-65	0
1847	1,112	1855	31,316	1866	13,000
1848	890	1856	15,728	1867	30,175
1849	2,700	1857	15,822	1868	1,700
1850	6,800	1858	8,473	1869	7,425
1851	25,000	1859	39,194	1870	41,243

South American Trade of Baltimore.

With the outbreak of the Civil War in the United States, guano importations ceased abruptly. After the war, in September 1866, Baltimore agents once again began extensive importations, but the post-war South, once the center of demand, was not able to resume its former purchases. Other varieties of fertilizer were on the market in competition with Peruvian guano, and by 1875 nitrate of soda (saltpeter) had replaced guano as the leading United States importation from Peru.[6]

[3] 1 metric ton = 2204.6 pounds.

[4] RUTTER, FRANK R. SOUTH AMERICAN TRADE OF BALTIMORE. Johns Hopkins Univ. Studies Hist. and Polit. Sci., 15th Ser., IX, p. 43. (Quotation from *Price Current*, September 14, 1844.) 1897.

[5] *Ibid.*, p. 49.

[6] NOLAN, LOUIS CLINTON. *Op.cit.*

ADMINISTRATION OF GUANO IN RECENT YEARS

Since 1909 the collection and distribution of Peruvian guano has been in the hands of a government monopoly, the *Compañía Administradora del Guano*, with headquarters at Lima, Peru. The company extracts the guano, rations it out among the farmers according to their needs, exports small amounts from time to time, and profits from sales go into the government treasury. Under the able administration of the company, each of the islands has been made a bird sanctuary, closely guarded at all times by appointed wardens. The old method of extracting guano without consideration of the birds has been abandoned, and a system of rotation for working the islands has been adopted. After guano is removed from an island, that island is promptly vacated and left to the birds for 30 months, or longer if need be, before it is exploited again. Whereas the old method of exploitation drew upon the resources of past deposits, the new system is on a "sustained yield" basis.

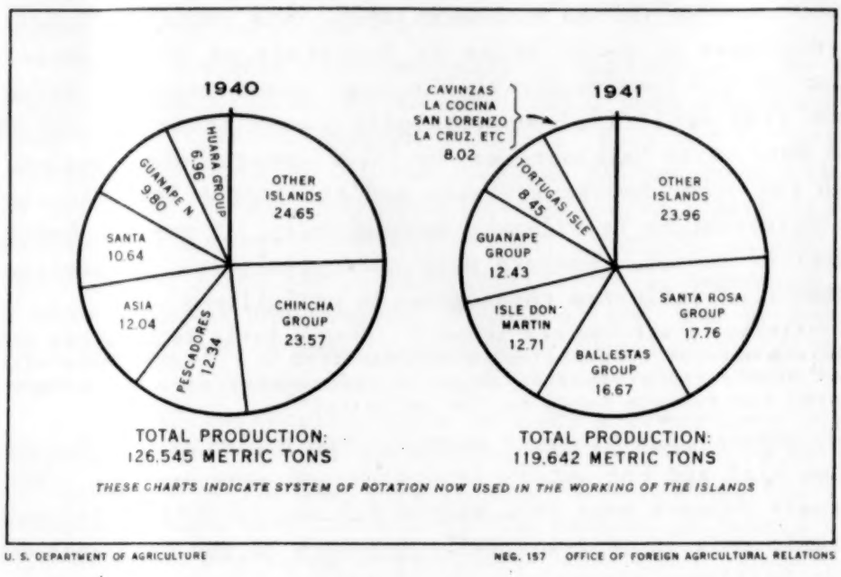
1940
HUARA GROUP 6.96
OTHER ISLANDS 24.65
CHINCHA GROUP 23.57
PESCADORES 12.34
ASIA 12.04
SANTA 10.64
GUANAPE N 9.80
TOTAL PRODUCTION: 126,545 METRIC TONS
1941
CAVINZAS LA COCINA SAN LORENZO LA CRUZ, ETC 8.02
TORTUGAS ISLE 8.45
OTHER ISLANDS 23.96
GUANAPE GROUP 12.43
SANTA ROSA GROUP 17.76
ISLE DON MARTIN 12.71
BALLESTAS GROUP 16.67
TOTAL PRODUCTION: 119,642 METRIC TONS
THESE CHARTS INDICATE SYSTEM OF ROTATION NOW USED IN THE WORKING OF THE ISLANDS
U. S. DEPARTMENT OF AGRICULTURE
NEG. 157 OFFICE OF FOREIGN AGRICULTURAL RELATIONS

FIGURE 2.—Percentage distribution of Peruvian guano production, by islands, 1940-41.

The extraction of guano is a simple process. Before the advent of North American extractive machinery the only implements required were the pick and shovel for breaking up the crust and throwing it into heaps. It was then shoveled through a wire screen to remove gravel and sacked for loading into row boats, or "lighters," which conveyed the cargo to the guano vessels waiting farther out at sea. The guano workers, mostly native Peruvians, lived in simple camps constructed on the islands while the work was going on; the Government has now begun to construct modern dormitories for them.

ECONOMICS OF THE GUANO INDUSTRY

Total guano production in 1942 was only 79,201 metric tons, the lowest since the 1927-28 season. Sales to domestic agriculture, however, totaled 83,220 metric tons,[7] and there were no exports (see figure 3). During the 1850's guano extraction averaged more than 500,000 metric tons annually, the greater part of which was exported. Since 1909 the greatest volume was attained in 1938, when extractions amounted to 169,786 metric tons. Since the latter year, extraction steadily decreased until it reached the low 1942 figure. The amount of guano needed (referred to as "petitioned" in table 2) by domestic agriculture usually exceeds extraction, and requirements have not been

[7] Stocks on hand from the previous season probably account for the difference.

TABLE 2.—*Distribution of Peruvian guano extracted by the Compañía Administradora del Guano, nitrogen content and profits from sales, 1909-1942*

YEAR	TOTAL GUANO EXTRACTED	PETITIONED BY DOMESTIC AGRICULTURE	SALES TO DOMESTIC AGRICULTURE	GUANO EXPORTED	NITROGEN CONTENT		PROFITS FROM SALES
					RICH	POOR	
Beginning April 1	*Metric tons*[1]	*Metric tons*	*Metric tons*	*Metric tons*	*Percent*	*Percent*	*Soles*[2]
1909	70,292	36,273	23,790	46,170	10.04	19.10	23,008
1910	90,747	63,529	31,938	58,480	10.70	18.75	33,317
1911	101,566	86,658	33,889	65,266	10.14	18.90	32,138
1912	70,172	108,654	33,837	36,425	9.18	17.75	33,868
1913	70,160	121,113	34,078	34,477	8.65	19.05	34,074
1914	76,200	139,173	30,607	43,917	9.36	18.93	32,038
1915	58,929	36,931	42,678	18,706	10.16	-	862,355
1916	54,472	43,374	51,211	-	11.82	-	1,050,326
1917	80,866	65,006	79,408	-	12.80	-	1,766,352
1918	74,076	62,454	72,892	-	12.28	-	1,299,024
1919	50,628	34,326	50,926	-	12.52	-	1,682,985
1920	68,174	55,586	57,351	4,064	13.13	-	1,976,608
1921	62,757	43,035	54,683	6,045	14.16	-	2,014,333
1922	84,337	43,372	63,743	24,028	13.42	-	2,214,276
1923	110,508	71,874	85,935	23,142	12.49	-	2,805,845
1924	148,046	92,477	109,146	22,332	12.99	-	3,700,815
1925	136,333	89,144	97,411	21,128	12.61	-	3,182,934
1926	80,404	64,347	68,301	10,983	12.80	-	2,224,623
1927	78,493	49,270	72,485	12,657	12.38	-	2,296,523
1928	125,471	97,487	106,271	16,208	13.36	-	3,695,067
1929	151,461	103,922	116,694	29,774	12.06	18.24	5,075,197
1930	132,974	86,611	92,453	32,487	12.96	-	4,388,355
1931	94,700	64,859	73,531	16,500	12.87	-	3,021,115
1932	133,741	79,497	88,686	47,357	13.18	16.71	5,436,058
1933	162,358	103,619	115,402	48,803	12.62	17.80	5,052,328
1934	148,256	136,720	131,840	14,463	12.79	-	3,332,543
1935	127,722	163,012	127,051	254	13.24	-	3,218,645
1936	136,056	206,428	133,595	375	13.23	-	3,402,873
1937	159,138	238,244	143,903	5.420	13.81	-	5,413,102
Beginning Jan. 1							
1938[3]	169,786	262,984	148,514	17,421	13.96	-	9,152,877
1939	152,778	228,324	137,105	14,927	13.57	-	7,642,948
1940	126,545	230,438	121,152	-	13.39	-	6,258,378
1941	119,642	197,834	114,422	8,747	13.29	-	7,282,650
1942	79,201	216,472	83,220	-	13.17	-	2,557,045
Total	3,586,989	3,723,047	2,828,148	680,556			102,194,622

[1] 1 metric ton = 2204.6 pounds.
[2] The Peruvian sole is currently worth about 15.4 U. S. cents.
[3] 9 months April 1 to December 31.
Boletin de la Compañía Administradora del Guano, February 1941, 1942, and 1943.

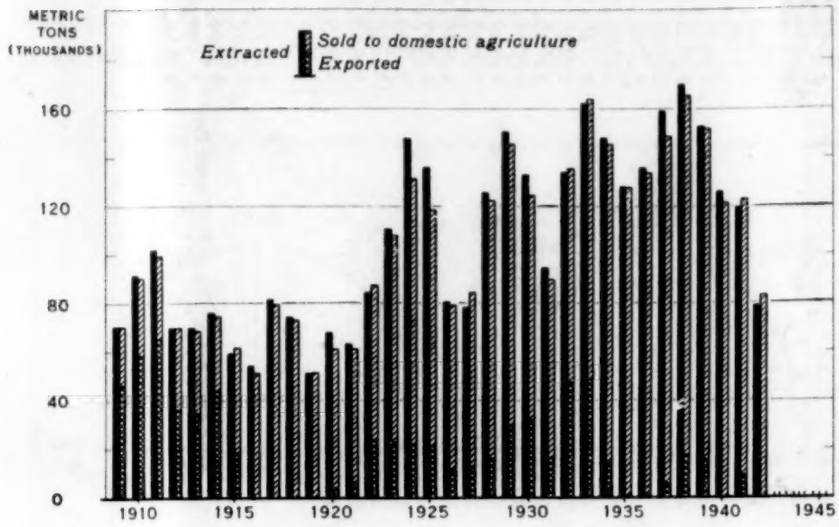

FIGURE 3.—Distribution of Peruvian guano production, 1909-42 (1909-37, year beginning April; beginning 1938, calendar year).

filled since about 1935, despite the relatively small amount exported from time to time. Reduced extraction at present is reflected in the small revenue received by the Government, which amounted to only 2,557,045 soles in 1942, against 9,152,877 soles in the peak year 1938.

In accordance with a Supreme resolution of February 4, 1943, the Company is required to show preference to domestic applications for guano for use in the cultivation of garden crops. By reducing the cotton acreage by 20 percent as the Government has ordered, more guano should be available for the production of foodstuffs. Since 1941 guano to be used for cultivating cotton has fallen off by almost 50 percent, and for sugarcane by more than 50 percent, possibly indicating an increase in the amount used for producing foodstuffs.

The alarming decrease in guano production is attributed directly to adverse meteorological and oceanographic conditions that have driven the anchovies away from the islands and thus have caused the death or disappearance of large numbers of birds. According to Dr. Vogt,[8] who has just completed a 3-year study of the birds and the islands, there has been a definite upward trend in the bird population during the administration of the Compañía. Although the smoothed curve of this trend shows an increase in population, there have been fairly regular reverses. So-called "climatic upheavals" occur with more or less regularity about every seventh year. These cyclic periods are characterized by higher sea temperatures, increased precipitation in the north, and apparently an abnormal proportion of westerly winds. Although the loss of birds during these periods can never be entirely controlled, some measures for building up the bird population recommended to the Compañía are: Greater protection of the birds' food supply (anchobetas); protection of birds against disease; improvement and reconditioning of the islands to better nesting conditions; control of creatures that prey on the birds and the protection of those that are beneficial; and an educational program for school children to teach them the value of the guano birds and encourage their protection, as well as a program to encourage and educate the wardens of the islands.

Although the Compañía does not anticipate any increase in this year's output of guano, the great hope is that this cyclic disturbance will shortly terminate and that once more Peru will have an abundance of guano for domestic use and possibly enough to resume exports. Thus Peruvian food production might be increased and that of other nations as well.

[8] VOGT, WILLIAM. AVES GUANERAS... Co. Adminr. del Guano Bol. 18(3): 1-132, illus. [Lima, Peru.] (English Translation, a report on a study of three guano birds, unpublished.)

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